Indian Head Division
Naval Surface Warfare Center
Indian Head, MD 20640-5035

IHTR 2373
31 August 2001

SENSITIVITY TESTING OF CONTAMINATED SURFACES TO ESTABLISH NON-REACTIVITY LEVELS OF HMX, TATB, HBNQ, NC, AND TETRYL ON WOOD, CONCRETE, AND METAL

Anne E. H. Caris

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Small-scale sensitivity testing was performed to establish levels of contamination that would not exhibit reactions to normally executed construction practices. Standard friction, impact, and electrostatic discharge (ESD) sensitivity tests were used. Wood, concrete, and metal anvils and plates were prepared with a quantifiable amount of contaminant on the testing surfaces. The contaminants were HMX, TATB, HBNQ, NC, and tetryl. Results are given.

15. SUBJECT TERMS

Sensitivity testing	HBNQ
HMX	Nitrocellulose
TATB	Tetryl

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FOREWORD

This report is an adjunct to IHTR 2269, which addressed the explosive contamination levels to which surfaces needed to be cleaned before being released for unrestricted use per DOD 6055.1. This report deals with five additional energetic materials—HMX, TATB, HBNQ, NC, and tetryl. Also, the three original energetic materials, TNT, RDX, and AP, were tested for sensitivity on wood surfaces at the 750-μg/cm^2 level. This report should be used in concert with IHTR 2269.

This work was performed at the Indian Head Division, Naval Surface Warfare Center.

Joseph D. Anderson
Manager, Facilities Modernization Branch

Approved by:

Raymond A. Geckle
Director, Cast Products Technology Division

Released by:

N. Bertucci
Head, Applied Technology Department

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BACKGROUND

The downsizing and closing of military establishments have generated the need to eliminate potential hazards from facilities previously used to process energetic materials. Testing for contamination levels is an established practice; however, there are no established criteria for safe and acceptable levels of contamination of facilities.

To establish levels of contamination with appropriate safety factors that could be shown not to exhibit reactions to normally executed construction practices, such as equipment installation and facility remodeling, small-scale sensitivity testing was performed. Wood, concrete, and metal anvils and plates were prepared for use in the sensitivity equipment and then coated with a quantifiable amount of contaminant on the testing surface. These plates and anvils were then subjected to impact, friction, and electrostatic discharge (ESD) sensitivity testing and observed for reactions to the stimuli.

IHTR 2269, *Sensitivity Testing of Contaminated Surfaces to Establish Non-Reactivity Levels of Ammonium Perchlorate, Cyclotrimethylenetrinitramine, and Trinitrotoluene on Wood, Concrete, and Metal,* 30 June 2000, reported on previous testing with AP, RDX, and TNT. This report gives results of testing with five additional materials—HMX (cyclotetramethylenetetranitramine), TATB (triaminotrinitrobenzene), HBNQ (high-bulk-density nitroguanidine), NC (nitrocellulose), and tetryl (trinitrophenylmethylnitramine). Also reported is the sensitivity of the three original materials on wood surfaces at the 750-μg/cm^2 level.

APPROACH

We used several time-honored sensitivity tests for the hazard classification of energetic materials:

- Naval Ordnance Station (NOS) Impact Test
- Alleghany Ballistic Lab (ABL) Friction Test
- ABL Electrostatic Discharge test

These tests cover the gamut of stimuli expected to be experienced during the demolition/decontamination effort.

The procedures for these tests are well defined including the assembly of the test apparatus and preparation of the specimen to be tested. The anvils/plates reflected the surfaces expected to be encountered—metal, wood, or concrete. To determine the level to which contaminated surfaces must be cleaned, plates/anvils containing increasing quantities of the energetic material were tested on the above apparatus until a "reaction" was achieved. The level to which a surface must be cleaned was the next lowest level and one in which no reaction was achieved. Since friction is the stimulus to be experienced most often, the maximum pressure of 980 psig was assigned to depict the "worst case" situation.

To assure consistent and accurate deposition on the plates/anvils, the energetic materials were dissolved in an appropriate solvent to a specified concentration. A pipette was used to apply the energetic material to the surface.

Directions for sample preparation and testing were communicated to the laboratories via action memoranda (Appendix A).

DISCUSSION OF RESULTS

1. The results as reported by the laboratories (Appendix B) are straightforward and confirm engineering analysis of on-site evaluations. However, one anomaly occurred in the HMX series. The 200-μg/cm^2 sample reacted on the steel anvil while the 500-μg/cm^2 sample did not. This anomaly dictated a retest of the HMX series especially since the RDX series exhibited reactions on steel at 100 μg/cm^2 with no reaction at 75 μg/cm^2.

2. All the contaminants presented "no reaction" at concentrations up to and including 750 μg/cm^2 on wood and concrete in the friction and impact tests.

3. All concentrations (50, 75, 100 μg/cm^2) had at least one reaction to ESD. Examination of the anvils/plates indicated only a minimal reaction.

4. Review of Appendix E of IHTR 2269 demonstrates "no reactions" at pressures below 980 psig on RDX. This supports the contention that 980 psig represents the "worse case" situation.

5. Post-test inspections of the concrete-filled friction plates and raw test data indicated that the concrete did not hold up to the friction wheel testing set at 980-psig pressure. Further evaluation of material preparation is necessary. It is reasonable to use the non-reactive levels reported on the steel friction plates for clearance.

CONCLUSIONS

1. Structure surfaces need to be cleaned/decontaminated to 750 μg/cm^2 or less. Steel surfaces (equipment) must be cleaned to 500 μg/cm^2 or less.

2. To preclude initiation by ESD, all hands must be "grounded" in the mode specified in ordnance industry safety manuals—conductive shoes/ground straps, cotton clothing, etc.

3. The HMX friction series was repeated with reactions at 100, 200 and 500 μg/cm^2 per Memorandum Report No. 3 (Appendix B). This validated the original no-reaction levels of 50 and 75 μg/cm^2.

Appendix A

ACTION MEMORANDA

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ACTION MEMORANDUM NO. 1

To: Laura Tinsley 3320J
From: Anne Caris 2150K

Subj: Test Sample Preparation, Request for

1. Please prepare the plates and anvils provided with the energetics listed below by applying the required quantity of solution (solvent as indicated) to realize the level of contamination listed.

2. Please provide a copy of your calculations of solution concentrations and quantity of solution to be applied for each contaminant level.

Table 1. Required contamination

Contaminant	Contaminant level	Substrates	Test
HMX- Acetonitrile	50 µg/cm^2 75 µg/cm^2 100 µg/cm^2 200 µg/cm^2 500 µg/cm^2 750 µg/cm^2 200 µg/cm^2 500 µg/cm^2 750 µg/cm^2 50 µg/cm^2 75 µg/cm^2 100 µg/cm^2	1 metal plate 1 metal plate 1 metal plate 1 metal plate, 1 wood plate, 1 concrete plate 1 metal plate, 1 wood plate, 1 concrete plate 1 wood plate, 1 concrete plate 1 metal anvil, 1 concrete anvil, 1 wood anvil 1 metal anvil, 1 concrete anvil, 1 wood anvil 1 metal anvil, 1 concrete anvil, 1 wood anvil 20 metal anvils 20 metal anvils 20 metal anvils	friction friction friction friction friction friction impact impact impact ESD ESD ESD
HBNQ- Water	50 µg/cm^2 75 µg/cm^2 100 µg/cm^2 200 µg/cm^2 500 µg/cm^2 750 µg/cm^2 200 µg/cm^2 500 µg/cm^2 750 µg/cm^2 50 µg/cm^2 75 µg/cm^2 100 µg/cm^2	1 metal plate 1 metal plate 1 metal plate 1 metal plate, 1 wood plate, 1 concrete plate 1 metal plate, 1 wood plate, 1 concrete plate 1 wood plate, 1 concrete plate 1 metal anvil, 1 concrete anvil, 1 wood anvil 1 metal anvil, 1 concrete anvil, 1 wood anvil 1 metal anvil, 1 concrete anvil, 1 wood anvil 20 metal anvils 20 metal anvils 20 metal anvils	friction friction friction friction friction friction impact impact impact ESD ESD ESD

NC-Tetrahydra Furan	50 µg/cm^2	1 metal plate	friction
	75 µg/cm^2	1 metal plate	friction
	100 µg/cm^2	1 metal plate	friction
	200 µg/cm^2	1 metal plate, 1 wood plate, 1 concrete plate	friction
	500 µg/cm^2	1 metal plate, 1 wood plate, 1 concrete plate	friction
	750 µg/cm^2	1 wood plate, 1 concrete plate	friction
	200 µg/cm^2	1 metal anvil, 1 concrete anvil, 1 wood anvil	impact
	500 µg/cm^2	1 metal anvil, 1 concrete anvil, 1 wood anvil	impact
	750 µg/cm^2	1 metal anvil, 1 concrete anvil, 1 wood anvil	impact
	50 µg/cm^2	20 metal anvils	ESD
	75 µg/cm^2	20 metal anvils	ESD
	100 µg/cm^2	20 metal anvils	ESD
TATB-Dimethyl Formamide	50 µg/cm^2	1 metal plate	friction
	75 µg/cm^2	1 metal plate	friction
	100 µg/cm^2	1 metal plate	friction
	200 µg/cm^2	1 metal plate, 1 wood plate, 1 concrete plate	friction
	500 µg/cm^2	1 metal plate, 1 wood plate, 1 concrete plate	friction
	750 µg/cm^2	1 wood plate, 1 concrete plate	friction
	200 µg/cm^2	1 metal anvil, 1 concrete anvil, 1 wood anvil	impact
	500 µg/cm^2	1 metal anvil, 1 concrete anvil, 1 wood anvil	impact
	750 µg/cm^2	1 metal anvil, 1 concrete anvil, 1 wood anvil	impact
	50 µg/cm^2	20 metal anvils	ESD
	75 µg/cm^2	20 metal anvils	ESD
	100 µg/cm^2	20 metal anvils	ESD
Tetryl-Acetonitrile	50 µg/cm^2	1 metal plate	friction
	75 µg/cm^2	1 metal plate	friction
	100 µg/cm^2	1 metal plate	friction
	200 µg/cm^2	1 metal plate, 1 wood plate, 1 concrete plate	friction
	500 µg/cm^2	1 metal plate, 1 wood plate, 1 concrete plate	friction
	750 µg/cm^2	1 wood plate, 1 concrete plate	friction
	200 µg/cm^2	1 metal anvil, 1 concrete anvil, 1 wood anvil	impact
	500 µg/cm^2	1 metal anvil, 1 concrete anvil, 1 wood anvil	impact
	750 µg/cm^2	1 metal anvil, 1 concrete anvil, 1 wood anvil	impact
	50 µg/cm^2	20 metal anvils	ESD
	75 µg/cm^2	20 metal anvils	ESD
	100 µg/cm^2	20 metal anvils	ESD
TNT-Acetonitrile	750 µg/cm^2	1 wood plate	friction
	750 µg/cm^2	1 metal anvil, 1 concrete anvil, 1 wood anvil	impact
RDX-Acetonitrile	750 µg/cm^2	1 wood plate	friction
	750 µg/cm^2	1 metal anvil, 1 concrete anvil, 1 wood anvil	impact
AP-Water	750 µg/cm^2	1 wood plate	friction
	750 µg/cm^2	1 metal anvil, 1 concrete anvil, 1 wood anvil	impact

ACTION MEMORANDUM NO. 2

To: Sensitivity Lab
From: Anne Caris 2150K

Subj: Sensitivity Testing, Request for

1. Please perform tests listed in the tables below.

2. The plates and anvils will be delivered pre-contaminated and labeled to level of contaminations.

3. Total number of friction plates to be tested = 58. Total number of impact anvils to be tested = 54. Total number of ESD anvils to be tested = 300.

4. Please provide results per memorandum as soon as possible.

Table 1. Summary of required friction sensitivity tests

Test	Contaminant	Level of contamination	Substrate	Number of friction plates to be tested
Friction	HMX	50 µg/cm^2	metal	1
		75 µg/cm^2	metal	1
		100 µg/cm^2	metal	1
		200 µg/cm^2	wood, concrete, metal	3 = 11
		500 µg/cm^2	wood, concrete, metal	3
		750 µg/cm^2	wood, concrete	2
	TATB	50 µg/cm^2	metal	1
		75 µg/cm^2	metal	1
		100 µg/cm^2	metal	1
		200 µg/cm^2	wood, concrete, metal	3 = 11
		500 µg/cm^2	wood, concrete, metal	3
		750 µg/cm^2	wood, concrete	2
	HBNQ	50 µg/cm^2	metal	1
		75 µg/cm^2	metal	1
		100 µg/cm^2	metal	1
		200 µg/cm^2	wood, concrete, metal	3 = 11
		500 µg/cm^2	wood, concrete, metal	3
		750 µg/cm^2	wood, concrete	2
	NC	50 µg/cm^2	metal	1
		75 µg/cm^2	metal	1
		100 µg/cm^2	metal	1
		200 µg/cm^2	wood, concrete, metal	3 = 11
		500 µg/cm^2	wood, concrete, metal	3
		750 µg/cm^2	wood, concrete	2
	Tetryl	50 µg/cm^2	metal	1
		75 µg/cm^2	metal	1
		100 µg/cm^2	metal	1
		200 µg/cm^2	wood, concrete, metal	3 = 11
		500 µg/cm^2	wood, concrete, metal	3
		750 µg/cm^2	wood, concrete	2
	TNT	750 µg/cm^2	wood	1
	RDX	750 µg/cm^2	wood	1
	AP	750 µg/cm^2	wood	1

Table 2. Summary of required impact sensitivity tests				
Test	Contaminant	Level of contamination	Substrate	Number of impact anvils to be tested
Impact	HMX	200 µg/cm^2 500 µg/cm^2 750 µg/cm^2	wood, concrete, metal wood, concrete, metal wood, concrete, metal	3 3 = 9 3
	TATB	200 µg/cm^2 500 µg/cm^2 750 µg/cm^2	wood, concrete, metal wood, concrete, metal wood, concrete, metal	3 3 = 9 3
	HBNQ	200 µg/cm^2 500 µg/cm^2 750 µg/cm^2	wood, concrete, metal wood, concrete, metal wood, concrete, metal	3 3 = 9 3
	NC	200 µg/cm^2 500 µg/cm^2 750 µg/cm^2	wood, concrete, metal wood, concrete, metal wood, concrete, metal	3 3 = 9 3
	Tetryl	200 µg/cm^2 500 µg/cm^2 750 µg/cm^2	wood, concrete, metal wood, concrete, metal wood, concrete, metal	3 3 = 9 3
	TNT	750 µg/cm^2	wood, concrete, metal	3
	RDX	750 µg/cm^2	wood, concrete, metal	3
	AP	750 µg/cm^2	wood, concrete, metal	3

Table 3. Summary of required ESD sensitivity tests				
Test	Contaminant	Level of contamination	Substrate	Number of ESD anvils to be tested
ESD	HMX	50 µg/cm^2 75 µg/cm^2 100 µg/cm^2	metal metal metal	20 20 20
	TATB	50 µg/cm^2 75 µg/cm^2 100 µg/cm^2	metal metal metal	20 20 20
	HBNQ	50 µg/cm^2 75 µg/cm^2 100 µg/cm^2	metal metal metal	20 20 20
	NC	50 µg/cm^2 75 µg/cm^2 100 µg/cm^2	metal metal metal	20 20 20
	Tetryl	50 µg/cm^2 75 µg/cm^2 100 µg/cm^2	metal metal metal	20 20 20

4. Address any question regarding this memo to Anne Caris, at ext. 1892 or by email to carisae@ih.navy.mil.

Appendix B

RESULTS MEMORANDA

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MEMORANDUM REPORT NO. 1

To: Anne Caris 2150K
From: Laura Tinsley 3320J

Subj: Calculations to determine amount of standard solution to be applied to each testing surface.

Friction plate surface area = 10 cm x 4 cm = 40 cm^2
Impact anvil surface area = (3.14159) x (3.175/2 cm)^2 = 7.54 cm^2
ESD anvil surface area = (3.14159) x (.3175 cm)^2 = 0.32 cm^2

Contamination levels for friction plates: 50, 75, 100, 200, 750 micrograms per square centimeter
Contamination levels for impact anvils: 200, 500, 750 micrograms per square centimeter
Contamination levels for ESD anvils: 50, 75, 100 micrograms per square centimeter

HBNQ standard solution is 0.01 grams/100 milliliter

for ESD anvil = (50 $\mu g/cm^2$)(0.32 cm^2)= 16 μg

(100 ml/0.01g) = (x/16 μg) X = (16 μg)(100 ml)/(0.01g) = 0.16 ml or 160 μl

= (75 $\mu g/cm^2$)(0.32 cm^2) = 24 μg

(100 ml/0.01g) = (x/24 μg) X = (24 μg)(100 ml)/(0.01g) = 0.24 ml or 240 μl

= (10 $\mu g/cm^2$)(0.32 cm^2) = 32 μg

(100 ml/0.01g) = x/32 μg) X = (32 μg)(100 ml)/(0.01g) = 0.32 ml or 320 μl

for impact anvils = (50 $\mu g/cm^2$)(7.54 cm^2) = 377 μg

(100 ml/0.01g) = (x/377 μg) X = (377 μg)(100 ml)/(0.01g) = 3,770,000 ml or

= (75 $\mu g/cm^2$)(0.32 cm^2) = 24 μg

(100 ml/0.01g) = (x/24 μg) X = (24 μg)(100 ml)/(0.01g) = 0.24 ml or 240 μl

= (100 $\mu g/cm^2$)(0.32 cm^2) = 32 μg

(100 ml/0.01g) = (x/32 μg) X = (32 μg)(100 ml)/(0.01g) = 0.32 ml or 320 μl

TATB standard solution is 0.004 g/100 milliliter

(50 $\mu g/cm^2$)(0.32 cm2)= 16 μg

(100 ml/0.004g) = (x/16 μg) X = (16 μg)(100 ml)/(0.004g) = 0.4 ml or 400 μl

(75 $\mu g/cm^2$)(0.32 cm^2) = 24 μg
(100 ml/0.004g) = (x/24 μg) X = (24 μg)(100 ml)/(0.004g) = 0.6 ml or 600 μl

(100 $\mu g/cm^2$)(0.32 cm^2) = 32 μg

(100 ml/0.004g) = (x/32 μg) X = (32 μg)(100 ml)/(0.004g) = 0.8 ml or 800 μl

MEMORANDUM REPORT NO. 2

To: Anne Caris 2150K
From: Dan Remmers 9410G

Subj: Sensitivity Testing for Contaminated Steel, Wood, and Concrete

Ref: (a) Request by A. Caris, Code 2150K on 16 August 2000.

1. As requested by reference (a), small scale safety testing was performed on concrete, steel, and wood contaminated with HMX, TATB, HBNQ, NC, tetryl, TNT, RDX, and AP. The tests and results are explained below, and the individual test worksheets were provided.

2. ABL Friction

HMX: The 200 $\mu g/cm^2$ concentration on the steel anvil had a positive reaction at 980 psig. All other concentrations on steel (50, 75, 100, 500 $\mu g/cm^2$) had no reactions at 980 psig.

All HMX concentrations on wood anvils (200, 500, 750 $\mu g/cm^2$) had no reactions.

All HMX concentrations on concrete anvils (200, 500, 750 $\mu g/cm^2$) had no reactions.

TATB: All TATB concentrations on steel anvils (50, 75, 100, 200, 500 $\mu g/cm^2$) had no reactions.

All TATB concentrations on wood anvils (200, 500, 750 $\mu g/cm^2$) had no reactions.

All TATB concentrations on concrete anvils (200, 500, 750 $\mu g/cm^2$) had no reactions.

HBNQ: All HBNQ concentrations on steel anvils (50, 75, 100, 200, 500 $\mu g/cm^2$) had no reactions.

All HBNQ concentrations on wood anvils (200, 500, 750 $\mu g/cm^2$) had no reactions.

All HBNQ concentrations on concrete anvils (200, 500, 750 $\mu g/cm^2$) had no reactions.

NC: All NC concentrations on steel anvils (75, 100, 200, 500, 750 $\mu g/cm^2$) had no reactions.

All NC concentrations on wood anvils (200, 500, 750 $\mu g/cm^2$) had no reactions.

All NC concentrations on concrete anvils (200, 500, 750 $\mu g/cm^2$) had no reactions.

tetryl: The 100, 200, and 500 $\mu g/cm^2$ concentrations on steel had a positive reaction at 980 psig. All other concentrations on steel (50, 75 $\mu g/cm^2$) had no reactions at 980 psig.

All tetryl concentrations on wood anvils (200, 500, 750 $\mu g/cm^2$) had no reactions.

All tetryl concentrations on concrete anvils (200, 500, 750 $\mu g/cm^2$) had no reactions.

TNT: 750 $\mu g/cm^2$ on the wood anvil had no reactions.

RDX: 750 $\mu g/cm^2$ on the wood anvil had no reactions.

AP: 750 $\mu g/cm^2$ on the wood anvil had no reactions.

3. NOS Impact

HMX: All HMX concentrations on steel anvils (200, 500, 750 $\mu g/cm^2$) had no reactions at the 1000 mm drop height.

All HMX concentrations on wood anvils (200, 500, 750 $\mu g/cm^2$) had no reactions at the 1000 mm drop height.

All HMX concentrations on concrete anvils (200, 500, 750 $\mu g/cm^2$) had no reactions at the 1000 mm drop height.

TATB: All TATB concentrations on steel anvils (200, 500, 750 $\mu g/cm^2$) had no reactions at the 1000 mm drop height.

All TATB concentrations on wood anvils (200, 500, 750 $\mu g/cm^2$) had no reactions at the 1000 mm drop height.

All TATB concentrations on concrete anvils (200, 500, 750 $\mu g/cm^2$) had no reactions at the 1000 mm drop height.

HBNQ: All HBNQ concentrations on steel anvils (200, 500, 750 $\mu g/cm^2$) had no reactions at the 1000 mm drop height.

All HBNQ concentrations on wood anvils (200, 500, 750 $\mu g/cm^2$) had no reactions at the 1000 mm drop height.

All HBNQ concentrations on concrete anvils (200, 500, 750 $\mu g/cm^2$) had no reactions at the 1000 mm drop height.

NC: The 750 $\mu g/cm^2$ concentration on the steel anvil had a positive reaction at the 1000 mm drop height. All other concentrations on steel (200, 500 $\mu g/cm^2$) had no reactions at the 1000 mm drop height.

All NC concentrations on wood anvils (200, 500, 750 $\mu g/cm^2$) had no reactions at the 1000 mm drop height.

All NC concentrations on concrete anvils (200, 500, 750 $\mu g/cm^2$) had no reactions at the 1000 mm drop height.

tetryl: All tetryl concentrations on steel anvils (200, 500, 750 $\mu g/cm^2$) had no reactions at the 1000 mm drop height.

All tetryl concentrations on wood anvils (200, 500, 750 $\mu g/cm^2$) had no reactions at the 1000 mm drop height.

All tetryl concentrations on concrete anvils (200, 500, 750 $\mu g/cm^2$) had no reactions at the 1000 mm drop height.

TNT: 750 $\mu g/cm^2$ on the steel anvil had no reactions.

750 $\mu g/cm^2$ on the wood anvil had no reactions.

750 $\mu g/cm^2$ on the concrete anvil had no reactions.

RDX: 750 $\mu g/cm^2$ on the steel anvil had no reactions.

750 $\mu g/cm^2$ on the wood anvil had no reactions.

750 $\mu g/cm^2$ on the concrete anvil had no reactions.

AP: 750 $\mu g/cm^2$ on the steel anvil had no reactions.

750 $\mu g/cm^2$ on the wood anvil had no reactions.

750 $\mu g/cm^2$ on the concrete anvil had no reactions.

4. ABL Electrostatic Discharge

All concentrations (50, 75, 100 $\mu g/cm^2$) of all contaminants had at least one reaction to electrostatic discharge. The individual test sheets were provided, along with a list of the pin number and the reaction. The NC contaminated pins were retested.

5. The tests were completed on November 2, 2000. Testing was conducted at NSWC Indian Head, in the Hazard Characterization Lab, Building 888. If there are any questions, please call the Hazard Characterization Group at 301-744-4109 or send a FAX at 301-744-4116.

Daniel Remmers
Hazard Characterization Group

5100
Ser 9410G/16/dr
21 February 2001

MEMORANDUM

To: Anne Caris 2150K
From: Dan Remmers 9410G

Subj: SENSITIVITY TESTING FOR HMX CONTAMINATED STEEL

Ref: (a) Request by A. Caris, Code 2150K on 6 February 2001.

1. As requested by reference (a), ABL friction testing was performed on steel contaminated with HMX. The concentrations provided were 200 and 500 $\mu g/cm^2$.

2. Both the 200 and 500 $\mu g/cm^2$ concentrations on the steel anvil had positive reactions at 980 psig. The individual worksheets are attached.

3. The tests were completed on February 13, 2001. Testing was conducted at NSWC Indian Head, in the Hazard Characterization Lab, Building 888. If there are any questions, please call the Hazard Characterization Group at 301-744-4109 or send a FAX at 301-744-4116.

Daniel Remmers
Hazard Characterization Group

ABL FRICTION TEST

sample name: HMX contaminated steel
sample ID: 200 µg/cm2
sample prep: residue
requester: Anne Caris, 2150K
operator: T. Tolson

date: 2/13/01
temperature: 29 °C
relative humidity: 30 %

psig	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	comments
980	1	1																			yellow sparks
750																					
560																					
420																					
315																					
235																					
180																					
135																					
100																					
75																					
55																					
40																					
30																					

1 = positive reaction (fire)
0 = negative reaction (no-fire)

20 TIL Friction: **0** psig

The threshold initiation level (TIL) is the level at which 20 negatives are observed with at least one positive at the next higher level.

Tested on ABL friction tester; at 8 ft/sec, with steel wheels and steel anvils, in building 888 room 104

ABL FRICTION TEST

sample name: HMX contaminated steel
sample ID: 500 µg/cm2
sample prep: residue
requester: Anne Caris, 2150K
operator: T. Chesley

date: 2/13/01
temperature: 29 °C
relative humidity: 30 %

psig	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	comments
980	1																				orange sparks
750																					
560																					
420																					
315																					
235																					
180																					
135																					
100																					
75																					
55																					
40																					
30																					

1 = positive reaction (fire)
0 = negative reaction (no-fire)

20 TIL Friction: 0 psig

The threshold initiation level (TIL) is the level at which 20 negatives are observed with at least one positive at the next higher level.

Tested on ABL friction tester; at 8 ft/sec, with steel wheels and steel anvils, in building 888 room 104

5100
Ser 9410G/21/dr
12 March 2001

MEMORANDUM

To: Anne Caris 2150K
From: Dan Remmers 9410G

Subj: SENSITIVITY TESTING FOR HMX CONTAMINATED STEEL

Ref: (a) Requests by A. Caris, Code 2150K on 23 February 2001.

1. As requested by reference (a), ABL friction testing was performed on steel contaminated with HMX. The concentrations provided were 100 and 150 $\mu g/cm^2$.

2. Both the 100 and 150 $\mu g/cm^2$ concentrations on the steel anvil had positive reactions at 980 psig. The individual worksheets are attached.

3. The tests were completed on February 28, 2001. Testing was conducted at NSWC Indian Head, in the Hazard Characterization Lab, Building 888. If there are any questions, please call the Hazard Characterization Group at 301-744-4109 or send a FAX at 301-744-4116.

Daniel Remmers
Hazard Characterization Group

ABL FRICTION TEST

sample name: HMX contaminated steel
sample ID: 100 µg/cm2
sample prep: residue
requester: Anne Caris, 2150K
operator: T. Tolson

date: 2/28/01
temperature: 28 °C
relative humidity: 31 %

psig	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	comments
980	0	1																			spark
750																					
560																					
420																					
315																					
235																					
180																					
135																					
100																					
75																					
55																					
40																					
30																					

1 = positive reaction (fire)
0 = negative reaction (no-fire)

20 TIL Friction: **0** psig

The threshold initiation level (TIL) is the level at which 20 negatives are observed with at least one positive at the next higher level.

Tested on ABL friction tester; at 8 ft/sec, with steel wheels and steel anvils, in building 888 room 104

ABL FRICTION TEST

sample name: HMX contaminated steel
sample ID: 150 µg/cm2
sample prep: residue
requester: Anne Caris, 2150K
operator: T. Tolson

date: 2/28/01
temperature: 28 °C
relative humidity: 31 %

psig	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	comments
980	1																				sparks
750																					
560																					
420																					
315																					
235																					
180																					
135																					
100																					
75																					
55																					
40																					
30																					

1 = positive reaction (fire)
0 = negative reaction (no-fire)

20 TIL Friction: **0** psig

The threshold initiation level (TIL) is the level at which 20 negatives are observed with at least one positive at the next higher level.

Tested on ABL friction tester; at 8 ft/sec, with steel wheels and steel anvils, in building 888 room 104

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raschke@dac-emh2.army.mil

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Internal:

OE	2
04	1
071	3
073	1
20	1
210	1
2120K	4
2150	4

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